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AGRICULTURAL IMPROVEMENTS: MANURES.  
[*DICTIONARY OF ECONOMIC PRODUCTS*, Vol. VI., M. 237-259.]

AGRICULTURAL IMPROVEMENTS IN THE GAYA  
DISTRICT.

*Note on the Institution of Agricultural Improvements on the Tikari Estate, Gaya District,—by DR. J. W. LEATHER, Agricultural Chemist to the Government of India.*

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*Other DICTIONARY articles that may be consulted:*

Crops, Vol. II., C. 2089.  
Fuel and Firewood, Vol. III., F. 716.  
Oxen, Vol. V., 574.



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E. C. BUCK,

*Secretary to the Government of India.*

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AGRICULTURAL IMPROVEMENTS IN THE GAYA DISTRICT.

*Note on the Institution of Agricultural Improvements on the Tikari Estate, Gaya District,—by DR. J. W. LEATHER, Agricultural Chemist to the Government of India.*

At the suggestion of Mr. W. C. Macpherson, Director of Land Records and Agriculture, Bengal, I visited Gaya on January 17th–20th, 1895. A question had been raised as to whether an experimental farm should be established at Gaya, and I was asked to express an opinion on the subject. During my stay I saw some land at Gaya which Mr. Ogilvy, the Manager of the estate, had thought might be utilised for the purpose, and I, also through the kindness of Mr. Ogilvy, had an opportunity of spending a couple of days at Tikari, which enabled me to see something of the agriculture of that neighbourhood.

2. When discussing the question of the institution of experiments or an experimental farm on a Court of Wards' estate, it is necessary, as Mr. Macpherson, Collector of Gaya, has pointed out to me, to bear in mind that the Court of Wards are placed in the position of Trustees and, therefore, are not at liberty to spend money on mere experiments, the utility of which may have no very direct value to the estate in question; they are at liberty to spend money only on what may be fairly expected to be works of real utility. This is, of course, a perfectly justifiable position to take, and I shall not lose sight of it in the present note.

For this reason it will be preferable to raise the question as to whether there are directions in which agricultural improvements may be instituted, rather than the one regarding an experimental farm, and then to consider whether a farm is the best means by which they can be carried out. Now, improvements are being constantly carried out on Wards' estates; such, for instance, are the sinking of wells, the keeping up of such watercourses as "pains" and "ahars," the making of country (*kucha*) roads, the making of mango *bahgs*. Here clearly we have instances of works of utility which are of value to the cultivator and, the zamindar alike, but which are nevertheless not equally capable of showing a direct improvement in the income derivable from the estate. Bettering the water-supply may be considered as a means of directly increasing the outturn of crops and the income of the estate, but the improvement in the means of

Experimental  
Farm in  
Tikari.

Relation of  
Government  
to Court of  
Wards'  
estates.

Improvement  
in Wards  
estates.

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## Agricultural Improvements

## Manure supply.

communication with the markets only *indirectly* improves the position of cultivator and zamindar. I draw attention to this point, because it illustrates the fact that the Court of Wards is justified, not only in spending money on works which will cause *immediate* improvement, but likewise on such as can be considered as only *indirect* improvements. There is, perhaps, nothing in relation to Indian agriculture which requires attention so much as the increase in the manure-supply of the empire. The same tale is told, whether we visit one presidency or another, the manure-supply is everywhere deficient and capable of improvement; I hardly think that any one will doubt this being the fact. True some have said that "only the nitrogen and organic matters of cattle dung are burnt and dissipated," but before the word "only" is employed in this connection a study of some of those experiments which have been made in England and in India should be undertaken, for they show, as clearly as it is possible to do, the value certainly to all cereal crops which at least the nitrogen has. The subject of the manure-supply of India has been discussed at very considerable length by Dr. Voelker in his recent Report on the Improvement of Indian Agriculture (1893), Chapter VII. I believe that this work is in the libraries of district officers, and I consider it unnecessary to quote from this chapter. The whole may with advantage be read.

## Treatment of sugarcane.

3. I may say that, judging from what I saw in the neighbourhood of Tikari, there is *very ample* room for improvement in this direction. I judge not only by the fact that I have rarely seen so little manure of any sort in villages, but I also confirm my opinion by what I saw of the sugarcane cultivation. The fields were being prepared for this crop, and here there was the manure which was to become the sole stimulus of what is probably one of the most exhausting crops known to Indian Agriculture. They were merely heaps of ashes, and small at that. The sugarcane crops corresponded to this treatment, for poorer crops I have rarely seen. A cultivator's estimate was about 20 maunds (*kachha*) to a *bigha*, which is equivalent to some 2,000lb of *gur* per acre. An examination of the cultivation around Tikari itself also adds proof—there was not a single field of "paunda" sugarcane, *i. e.*, the variety which is eaten raw, and for the cultivation of which more manure is invariably in the North-Western Provinces and Behar employed than for the cane which is crushed.

I mention this instance of the sugarcane to show that I have not merely come to the conclusion that the manure-supply around Tikari is poor like all the rest of India. The instances quoted and the general impression made on my mind led me to the opinion that the manure-supply in the neighbourhood I visited is *worse* than it is in many parts. The sugarcane cultivation indicates very fairly the amount of manure which is generally available at this place. But if the manure-supply is admittedly smaller than it ought to be, surely it would be a right and proper thing to spend money on attempts to improve it. It cannot even be considered as belonging to the category of improvements which exert only an *indirect* benefit to an estate, for an increase in the manure-supply produces an *immediate* increase in the outturn of crops, just as surely as an increase in the supply of water does. Another possible direction in which improvement may be effected on any estate is in the introduction of new crops or new varieties of crops. For example, it is known that better potatoes are grown in some places than in others; what is called the "Naini Tal" variety has proved itself superior to what is grown in many places in the plains. Another example (appertaining to the North-Western Provinces) is the superiority of the maize grown in the Jaunpur district over that grown at Cawnpur, or again in Guzrat (Bombay), the "bajrá" is a larger variety of *Pennisetum typhoides* than I have met with elsewhere. In

## New crops.

what direction improved varieties of crops, or even new crops, could be introduced for the benefit of the Tikari estate I cannot, after so short a visit, pretend to say, but the subject seems to me to be a perfectly legitimate one to put in the same category of works of utility as one would put increase of the water-supply. It appears to me to be a perfectly legitimate direction in which money might be spent. Again in the matter of cattle, surely it would be allowed to be a work of utility, if we know that the cattle on the estates are inferior to those in other parts similarly situated, to try to improve them. These are the principal directions in which improvements might, I think, be attempted at Tikari, and having formulated them, we may revert to the question of the institution of an experimental farm.

4. The improvement of the manure-supply, through the agency of a firewood-supply is, I consider, a subject which could only partially be undertaken on a "farm." As I shall explain in a later paragraph (5), there is certain information in relation to this subject of growing firewood which is wanting, and it might be preferable to try to obtain it at a "farm." But the main portion of the work would have to be done in the villages. The other two subjects, namely, the comparative testing of new or improved crops and the improvement in the breed of cattle, could very properly be carried out at a "farm." As stated in paragraph 1, I saw the land at Gaya, which Mr. Ogilvy thinks might be suitable. It is a piece of poor land, but I dare say with good manuring it would answer the purpose. Gaya is unfortunately somewhat away from the estate, and for the benefit of the cultivators it would have been better had it been at Tikari or somewhere more definitely in the estate.

It would, however, be useful in the first instance as a means of determining whether a certain crop, or a certain breed of cattle was likely to prove worth introducing into the villages of the estate. If situated at Gaya, it would have the advantage of being more frequently under Mr. Ogilvy's own inspection.

It is of course impossible to say what such a farm would cost. Mr. Ogilvy tells me he thinks that 20 acres would be sufficient. Mr. Ogilvy has some 200 acres of land on his hands in the estate, and he would propose that the manager of the farm would also superintend the cultivation of these lands, and he thinks he could recover the cost of the farm in this way. Whether this would prove so depends of course on circumstances. In the case of cattle-breeding, for example, one may spend a considerable amount of money on it. I think, judging by the cost of other small farms in India, that if the farm did not pay for itself, the nett cost should not exceed Rs. 2,000 per annum.

5. *The manure-supply.*—I cannot do better, in introducing this subject of the manure-supply, than quote from paragraph 100 of Dr. Voelcker's report, where he says:—"In the last chapter, after reviewing the sources of the manure-supply, we saw that they were very limited in number, and that the only material available in any quantity was the ordinary cattle dung. Further, we found that wherever wood was sufficiently abundant, dung was used for the land and it was not burnt; but that where wood was deficient, manure was burnt in the absence of any other source of fuel, and that the land was then deprived of it. The dependence of the soil for its fertility upon the supply of water and of manure was also instanced. The conclusion was accordingly drawn that the supply of wood to serve as fuel forms one of the most important factors in maintaining the fertility of the soil, or, in other words, the prosperity of agriculture. I can hardly put this too strongly, for it is the *one* practical measure on which I place the most importance; it is that which calls for

Exchange of Crops.

Growing firewood.

Manure-supply.

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Provision  
of firewood.

the most urgent attention, and from which the greatest benefits may be expected to follow. I make, in my report, other recommendations and suggestions, it is true, but I consider them *minor* ones compared with this."

The provision of firewood is to my mind one of the most urgent and pressing duties of zamindars in many parts of India and it is surely equally a duty of those who are managing the estates of minors. The native zamindar's education is unfortunately as a rule decidedly deficient, especially in the study of the principles of agriculture. His opportunities have been, up to the present, not very great, and there is consequently an excuse for him if he neglects this question of provision of fuel. But with Englishmen the same excuse cannot so readily be admitted. It is not a very abstruse subject, and most Englishmen know well the value which is placed on manure in Europe. Therefore it seems to me most desirable that this subject of the improvement in the manure-supply of the Indian raiyat should be taken up on Wards' estates and be classed as an improvement of the first importance.

It is quite true that the way to carrying it out has not been made so clear and simple as that of increasing the supply of water, but a beginning should be made, and the most feasible method of attaining this end determined. The regular supply of fuel has been carried out at but few places apart from certain forest areas, and consequently it is difficult to form any opinion on certain essential points. The best description of wood to grow; how should it be grown; when should it be cut; how much is obtainable from a given area; how much labour would be required to produce it, and how much fuel would be required per head of population, are all questions which have not as yet been properly worked out. The only estimate regarding fuel production, which I have been able to obtain, is attached herewith, in the hope that it may be of use. In the case of villages near Tikari it seemed to me that one of the first difficulties to be overcome is what lands one could set apart for the purpose. The whole of the country is cultivated, and there are not even those bare patches, called "village grazing grounds," at liberty. I saw some decidedly poor lands where the local stream had left a deposit of sand, and which can scarcely be yielding very large returns. It might prove of more use as a fuel-producing area than as a grain-producing one. But I saw other areas which might very easily be used for growing fuel; such are the banks of rivers or even large "plains." It is true that even the poorest lands on the river banks are cultivated more or less, but I feel sure that the increase in the manure-supply, which would accrue, would more than repay any loss of rent which the absorption of such land would entail. Regarding the description of tree to be grown, the babul is one of the most suitable in most parts of India. It is singularly absent from the neighbourhood of Tikari, but I cannot think it will not grow. The best sort of wood can, however, be determined only by experiments. This, and the value of providing fuel, could be very well tested by carrying out an experiment similar to that indicated in a note which I forwarded to Director of Land Records and Agriculture, Bengal, last year, and a copy of which I attach hereto. Such an experiment would be best carried out at a farm where arrangements for weighing the produce, etc., could be readily made.

New crops.

Rice not  
improved.

6. *New or improved crops.*—Around Tikari the greater area is occupied by rice. There is a good deal of sugarcane grown; but not much wheat or other of the usual rabi crops. Whether the rice can be improved, I cannot say. So far, I know of no improvement having been effected in relation to this crop.

In the matter of sugarcane, I believe that it is possible to obtain more than the people are at present able to do. As regards this subject, however, it will be better to await the results of the experiments which are being carried out at Poona and Cawnpur. They should enable us this year to determine what is a fair outturn per acre. The estimate of the Tikari raiyat, of about 2,000lb of *gur* per acre, seems very small.

7. *Improvement in the cattle.*—That the cattle around Tikari are diminutive, there can be no doubt, and it is not difficult to point to breeds of cattle in other parts of India which are far superior to them.

When, however, one raises the question as to which breed would be the best to introduce, we find objections certainly to some. For example, the large Hissar cattle are as fine as any in India. There are also the Mysore and the Nellore cattle, both of which are excellent. But they are all large cattle, and will require more food than the little beasts at present in use. Would they, or any of them, do more work than the indigenous ones, so as to pay for their feed? Again, will they stand the climate, and, more particularly, the ploughing of rice fields when under water? A definite answer to these questions can only be obtained by trial.

The most usual method of improving the breed of cattle in India, which has been tried, has been to keep a stud-bull for serving any cows that the cultivators may choose to bring, there being generally a nominal charge. It is a method which is simple of application, and I certainly think that something of the sort might be adopted at Tikari.

But if anything is done, it occurs to me that, in the first place at any rate, an attempt should be made to apply the process of "selection," i.e., one or two of the best bulls to be found in Bihar should be bought and kept for breeding purposes, rather than the institution of rash experiments with large cattle. If this were done, and the selected bulls well fed and kept in light work, it would soon become apparent whether improvement of the indigenous breed could not be attained.

I may, before leaving this part of the subject, refer for a moment to what, I understand, is known at Gaya as the "Patna" breed. It is a cross between the English "short horn" and the local breed. I saw several of these at Gaya. They are called "short horns," and are considered good milkers. They are a very degenerate beast, with straight back and without the "hump," in some cases good milkers, but, at least in the case of all that I saw, small sized (about 3½ or 4 feet) and with poor, weakly horns, a sure sign of poor breeding. If they are better milk-yielders than the local breed, they are no good as breeders for plough bullocks, and they form, to my mind, not at all a desirable breed to propagate.

If the people of Gaya saw a real "short horn" cow, they would at once admit the degeneracy at which this cross has arrived.

8. I have now touched upon the three directions in which it occurs to me money might legitimately be spent on an endeavour to improve the circumstances of the raiyats and at the same time the estate. Incidentally Mr Ogilvy mentioned two other matters which he thought might usefully be taken up. The one is improved *dairying*. The main outcome of dairying on European principles in India has been to show the very great value of it, principally for the European community and for jails, except in the Bombay Presidency. Natives have, however, not taken the matter up very readily so far. This is to be regretted, especially because one of the most important lessons they teach is the necessity of absolute cleanliness, not only in the dairy, but likewise in the cowsheds; improvement in the quality of the fodder is also shown to be advantageous. But I doubt if this matter could be placed on the footing of an improvement in the

Improvement  
in cattle.

Cross  
breeding.

Improvement  
of indigenous  
breed.

Weakly horns  
sign of poor  
breeding.

Patna Cross  
condemned.

Improved  
dairying.



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Utilisation of  
city night  
soil.

estate. If the agriculture generally is of the same order as around Tikari, it is certainly *not* a dairy country. It may, however, be mentioned that dairies have paid remarkably well, and provided they are properly managed, should show an actual profit and not a loss. Consequently, whilst I could not recommend this as a reason for the establishment of a farm at Gaya, nevertheless, if a farm *were* established, there could be no objection to having a dairy, provided it showed that it did not entail an extra nett charge. The other matter which Mr. Ogilvy thought might be taken up with advantage (but for which he proposes to utilise different land to that at the farm) is the better employment of night-soil and town sweepings at Gaya. I had no opportunity of seeing what is done with these materials, but, judging by what Mr. Ogilvy told me, there is much room for improvement.

There is in the neighbourhood of towns and large villages nothing of more importance than the proper and systematic utilisation of these materials, and it might, I think, be fairly considered as belonging to the category of agricultural improvements.

It is, moreover, a very *paying* thing when carried out properly, so that here, again, no large sum of money is required to be sunk in the hope of a merely future return. Mr. Ogilvy tells me that there is land near Gaya belonging to the estate which might be employed in this connection, and the increase in rents occasioned by it would fully repay any outlay on carts, etc. I may, however, mention that I believe one thing, at least, is needful for its success, and that is a *regular* supply of this manure to any set of cultivators. Where such material is employed, valuable crops, such as potatoes, only are grown, and the cultivators naturally alter their arrangements accordingly. They depend on this manure, and if the supply be suddenly cut off, they are left in the lurch. It has also to be borne in mind that a special set of men and carts have to be employed. There should therefore be a definite agreement with the municipality that a certain quantity shall be regularly, throughout the year, placed at the disposal of the purchasers.

Potatoes.

But given this condition, and provided the management is what it should be, the undertaking cannot fail to be a financial success. Regarding the best methods of dealing with the material, two seem to me to be the best of those in practice. The one is the trench system, in which a trench usually about one foot wide and one foot deep is dug and about three inches (not more) of night-soil put into it, and the earth then returned to the trench. The other is one recently adopted at Allahabad, and which is described at page 10 of the Report of the Allahabad Grass Farm, 1892-93. I have seen it in work and can recommend it. It is, I believe, only suitable for sewage which is fairly liquid.

9. I will now, in conclusion, touch upon a subject which was not submitted to me in connection with the question of the farm, but to which my attention was drawn more by accident than anything else. I happened to meet with the boy, Gopal Saran Narain Singh, who is the heir to the estates. He seems to be a bright little fellow, if somewhat delicate. But what struck me particularly was his love of animals. He showed me his cows, of which he is very proud, and which he calls "hansies" and "short horns," all of which are, however, a very degenerate lot. That he has a fairly good insight into the question how cattle should be kept, is shown by the remark he made to me "that they do not keep the cow-house clean." He also seemed very anxious for the establishment of the farm. It was one of the first things he asked me about.

Improvement  
of Minors.

Now, it occurred to me that there is a very excellent opportunity here for attempting a very radical (if later) improvement in the welfare of the

in the Gaya District.

(J. W. Leather.)

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estate. It has long been a conviction of mine that a great deal of good might be done if these youths, afterwards destined to become large landed proprietors, were encouraged to take an interest in practical agriculture and to study it; indeed, it seems to me that it is a most important item in their education.

One of the greatest drawbacks to Indian agriculture is that the large zamindars are generally very ignorant of the principles of agriculture. It is one reason why so little attempt is made to improve it.

If therefore it is not contemplated to place him at a college, it should prove a most valuable thing to him in after-life to allow a portion of his education to be practical agriculture. I have tried to show in previous paragraphs the advantages which might accrue to the estate by the establishment of a farm, and I think this last consideration has also a legitimate position in the same connection.

Training of  
minors.



All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr. George Watt, Reporter on Economic Products to the Government of India, Calcutta.

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions. Contributions or corrections and additions will therefore be most welcome.

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series. Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series; those on Forestry, in the Forest Series. Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom. In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series.

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This sheet and the title-page may be removed when the subject-matter is filed in its proper place, according to the letter and number shown at the bottom of each page.